lipid phase transitions. The differences in the thermotropic profiles of LAURDAN in NS and LBPs correlate with important differences in the thermotropic profile exhibited by the IR spectra of the same materials, suggesting the existence of significant structural differences between both types of surfactant organizations.

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Phase Behavior of Lipid Mixtures that Emulate the HIV-1 Membrane: A Monolayer Approach

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Disruption and/or deformation of the viral membrane are postulated to ensue during HIV-1 fusion. Contrasting this assumption, lipidomic analysis together with lipid-order estimations in infectious virions, support that the HIV envelope is a highly ordered lipid domain of restrained deformability. However, the mole percentages of SPM and Chol (18 and 45 %, respectively) actually suggest that this compositionally heterogeneous membrane may lie close to the boundary between Lo/Ld co-existence and pure Lo phase. Here, we use Langmuir lipid monolayers to study the phase behavior of synthetic lipid mixtures that are currently used as viral membrane models. Our data are consistent with the existence of a Lo phase under physiological conditions, which may co-exist with fluid domains upon subtle changes of membrane composition. We speculate that fluid nanodomains could be generated *in situ* upon fusion activation and subsequently exploited for the completion of the process.

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The Effects of NaCl on Oxidized Lipid Bilayers

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Lipid peroxidation plays an important role in cell membrane damage in which the polyunsaturated lipids are the main target for free radicals. The lipid bilayer systems of 1-palmitoyl-2-linoleoyl-sn-glycero-3-phosphatidylcholine (PLPC) and its 4 main oxidation products, namely 9-tc-hydroperoxide linoleic acid, 13-tc-hydroperoxide linoleic acid, 9-oxononanoic acid, and 12-oxo-9-dideca-dienoic acid were used to study the properties of oxidized lipid bilayer {Wong-ekkabut J., et al., Biophys. J., 2007 }. Our study showed that the oxidized lipid molecules were able to change the physical and mechanical properties of lipid bilayer. The effect of salt ions, important in living cells, have not been studied previously. Here, the effects of NaCl on the properties of oxidized lipid bilayers were studied by using molecular dynamics simulations. We found that the effects of the oxidized lipids in the bilayer were in good agreement with the previous studies {Wong-ekkabut J., et al., Biophys. J., 2007 }. The increasing concentrations of the oxidized lipids caused an increase of the area per lipid and a decrease of the bilayer thickness. A stable water defect was formed in the bilayer at a high concentration of oxidized lipids because the polar group in the oxidized lipid tail attracted the water dipoles. When salt molecules were added, sodium ions permeated into the head group region leading to a decrease of the area per lipid and an increase of the bilayer thickness. Our results show that salt ions decrease membrane fluidity and water permeability of the oxidized lipid bilayer.

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Impact of Oxidized Lipids on Membrane Structure and Dynamics and its Interactions with Proteins

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Oxidized phospholipids (OxPls)are involved in numerous pathological conditions. They are formed under oxidative stress and are therefore closely linked to programmed cell death events (apoptosis). Unfortunately, a coherent overall view of the causalities and mechanisms is lacking, mainly because of insufficient understanding of the occurring processes on a cellular and molecular level. In general, OxPLs are the oxidation products of (poly)unsaturated diacyl- and alk(en)ylacyl glycerophospholipids. Their differences in the structure, polarity and shape from their parent molecules can change the biophysical properties and function of membranes. Simultaneously changes in the lipid-protein interactions might result in the alternation of protein functions.
To characterize their impact on the organization of lipid membranes and involvement in specific protein-lipid interactions - with respect to protein misfolding but also the function of anti-apoptotic Bcl-2 protein - we study various biological lipid model systems by a combination of Solid State NMR, Circular Dichroism and Calorimetry techniques. DSC measurements revealed significant effects of OxPls on the physical behavior of DMPC bilayer especially at high concentration of OxPls. The size of changes was for all oxidized lipids used clearly visible but differentiated as a function of OxPls species (PazePc, PoxnoPc, POVPC,PGPC). The observed phase transition in these mixed DMPC bilayers were moved to higher temperatures in the presence of heavy water due to condensing effects. Temperature dependent solid state ^{31}P NMR lineshapes of lipid headgroups in OxPl-containing DMPC bilayers reflected their complex phase behavior as visible in the thermograms. In addition there was a two phase region visible where two different types of lamellar phases coexist. In addition, ^{2}H solid state NMR was used to characterize the hydration behavior (D_2O) at the membrane interface in the presense of OxPls.

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Ultrasound-Induced Nanofragmentation of Bubbles with Saturated and Unsaturated Lipid Coats

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Micron-sized lipid-coated bubbles are of considerable interest for applications in biomedical imaging and drug delivery. These bubbles have been reported to rapidly shrink when exposed to a series of short (~3 μs) ultrasound pulses, purportedly through a shedding of the coat during compression. Loss of coat would lead to an increase in surface tension and internal bubble pressure, enhancing diffusive loss of gas from the bubble long after the ultrasound pulse. For this mechanism, a coated bubble in ultrasound could shrink no faster than an uncoated bubble (absent ultrasound), as the shrinkage rate is entirely dominated by diffusive loss between pulses. Remarkably, we find that most insonated lipid-coated bubbles do shrink faster than quiescent uncoated bubbles. For the extra shrinkage observed to occur by enhanced diffusive loss during the 3 μs pulse, the diffusion coefficient of the gas would have to be increased by 100-1000x. If bubbles cannot shrink by diffusive loss of the gas, they must eject gas-entrapping fragments, even though no microscopically visible fragmentation was observed.
We have also studied the role of the lipid coat in bubble stability. We (and others) have observed that bubbles with saturated lipid coats shrink to a stable size of about 2 μm in diameter that persists indefinitely. Interestingly, we find that bubbles coated with an unsaturated lipid shrink to the same stable size, but it is short lived and the bubble catastrophically fragments after about 25-200 pulses. The differing fates of bubbles, and the nature of their fragmentation products, may have important consequences for efficacy in ultrasound-mediated drug delivery.
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Effect of Charge on DMPC/CHAPSO Bicellar Mixtures as Characterized by NMR and Sans

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Bicelles composed of 1,2-dimyristoyl phosphatidylcholine (DMPC) and the zwitterionic bile salt analogue 3-[(3-cholamidopropyl)dimethylammonio]-2-hydroxy-1-propanesulfonate (CHAPSO) are potential model membranes for structural NMR characterizations of membrane proteins in a high temperature environment. 25 wt% bicellar mixtures of DMPC/CHAPSO with molar ratio Q=3 were found to align well in a magnetic field at temperatures between 35°C - 55°C as probed by 31P-NMR. Doping with the negatively charged lipid 1,2-dimyristoyl phosphatidylglycerol (DMPG) at a DMPG/DMPC molar ratio R=0.10 extends the alignment temperature range to 30°C - 60°C. Diffusion of 2kDa polyethylene glycol (PEG) probe along the spacing between bicelles was studied using 1H Pulsed Field Gradient (PFG) NMR. In neutral bicelles, PEG exhibited curved exponential PFG NMR diffusion decays with diffusion coefficients that are diffusion-time dependent. However, the presence of charge in the bicelles enabled PEG to exhibit normal Gaussian diffusion with